Mid-Scale On-Farm Vermicompost Production

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I. Objectives

- Develop a mid-scale vermicomposting system to process mushroom stump waste and shredded newspaper.

II. Introduction and Background

Vermicomposting is a composting process carried out by earthworms and microorganisms. The basic components are: bedding material, horse manure (to promote microflora and microfauna), feedstock, surface-dwelling earthworms (*Eisenia foetida* or *Eudrillus eugenae*), surface protection, and water. Worm castings or vermicompost, are known to have very stable structure, release nutrients, promote aggregation, and hold water.

Vermicompost systems can range from inexpensive wood or plastic boxes to sophisticated modular units, that are self-contained and fully automated to keep controlled environmental conditions while processing waste into earthworm castings. Open systems range from windrows of variable scales to open field operations.
Vermicompost produced from the mixture of paper and food waste has similar characteristics to those of peat moss. Peat moss is the main material used as casing layer in commercial production of white button mushroom. Peat moss is a costly, "non-native", and "non-renewable" input. For a medium size grower (one producing 10,000 ft^2/week) it represents an approximate cost of $130,000 per year. Vermicompost has the advantage of being a material that growers can produce "on-farm", using own feedstock, and implementing either a mid-scale vermicomposting unit technology or a modular, self contained unit.
This project is a collaborative effort between UCCE-SCL, Royal Oaks Mushrooms, Countryside Mushrooms, BFI Organics Division, Z-Best/Zanker Road Landfill, CIWMB, City of San Jose Environmental Services Department, and County of Santa Clara Integrated Waste Management, and funded by CDFA-UC Specialty Crops.

III. Methods

This project consists of two independent experiments:
1) Developing a mid-scale windrow-type vermicomposting system to process mushroom stump waste and shredded newspaper.
A three (16'x8'x3') open-windrow system was set up in a small barn in Royal Oaks Mushroom Farm, Morgan Hill. The surface-dwelling earthworms *Eisenia foetida* in the windrows receive weekly or biweekly feeding that consists of mushroom stump waste generated in the farm, and shredded newspaper. Watering weekly or as needed. Vermicompost is harvested every 3-4 months. At harvest time, vermicompost is sifted through a 0.5 inch sieve.
2) Testing a modular vermicomposting unit

A BioSystem 500 ® unit (by BioSystem Solutions) was placed in the same location of the vermicompost windrows. The unit is a two-drawer cabinet, made of sturdy plastic, with a built-in fan/heating system to remove excessive moisture, requiring 120 Volts AC to operate. Not having electricity in the barn a solar-panel system was installed (Deep Cycle 12 V DC battery, 15 Watt/1 Amp ICP Solar Panel, ICP Charge Controller) and the existing fan was substituted by a 12 Volt DC fan.
The vermicompost drawers were set with earthworms, shredded newspaper and mushroom stump waste. The fan runs 6-8 hours a day, controlled with a 7-day timer.

IV. Partial Results

The operation of the windrows has required very little labor and maintenance. Manual harvesting is the most labor intensive activity, but mechanized harvesters are already available in the market.

The utilization of mushroom stump and newspaper and feedstock offer the advantage of producing non or very little smell during decomposition, and there has been very little presence of flies (as compared to fruit and vegetable waste).
Processing waste in a modular vermicomposting unit may offer advantages to urban composters or institutions composting on-site. There is need of improvement in the fan design to remove more efficiently excessive moisture from the drawers, as the compost produced here-in is very wet.
Vermicomposting has an average 60% (weight as is) efficiency conversion, plus the production of new worms (starters). Biological efficiency yet to be determined.

Vermicompost Yield in three production cycles					
Vermicompost Windrow	Mushroom waste	Shredded paper	Total Feed	Vermicompost harvested	Vermicompost/Feed
				Kg	
1	105	79	184	110	
	154	80	234	123	
	60	191	251	150	
Sub-total	319	350	669	383	0.6
2	83	83	166	102	
	148	86	234	149	
	56	193	249	124	
Sub-total	287	362	649	375	0.6
3	151	76	227	124	
	151	100	251	208	
	60	211	271	148	
Sub-total	362	387	749	480	0.6
Total	968	1099	2067	1238	0.6

V. References

Appelhof, M. 1982. *Worms Eat My Garbage*, Flower Press, Kalamazoo, Michigan, USA. 100 P.

Dougherty, M. 1999. *Field Guide to On-Farm Composting*. Natural Resource, Agriculture and Engineering Service (NRAES) Cooperative Extension, Ithaca, New York. 119 P.

Edwards, C. A. and P. J. Hohlen. 1996. *Biology and Ecology of Earthworms*. 3 rd Edition, Chapman and Hall, United Kingdom. 230 P.

Edwards, C. A. (Ed.). 1990. *Earthworm Ecology*. Soil and Water Conservation Society, Ankeny, Iowa, USA .

Martin, D. and G. Gershuny. (Eds.). 1992. *The Rodale Book of Composting*. Rodale Press, Emmaus, Pennsylvania. 278 P.

Zorba, F. (Ed.). 2001. *Worm Digest: The Art of Small Scale Vermicomposting*. Worm Digest, Eugene, Oregon. 24 P.